

# The Future of Science

RESEARCH CORPORATION  
*for* SCIENCE ADVANCEMENT  
*A foundation dedicated to science since 1912.*



## Summary of 2021 Awards

Research Corporation for Science Advancement (RCSA) supports early career scientists at colleges and universities in the United States and Canada through two core programs: the Cottrell Scholar Program and Scialog.

**Cottrell Scholar Program** – developing outstanding teacher-scholars recognized by their scientific communities for the quality of their research programs, innovation in education, and potential for academic leadership. In 2021, Cottrell Scholar Program funding included **\$2.5 million** for 25 initial Cottrell Scholar Awards, **\$75,000** for three Cottrell Scholars Collaborative Awards, and **\$265,000** for eight Cottrell Plus Awards, which include the competitive SEED, STAR and IMPACT awards. A second year of Cottrell Fellowships awarded **\$971,250** to 14 Cottrell Scholars to support postdocs working in their labs or groups. Three of these awards were funded through a grant from the National Science Foundation.

**Scialog** – promoting dialogue and community-building to catalyze transformational science through collaborative, interdisciplinary research. In 2021, RCSA awarded **\$1,424,000** to early career scientists for research through Scialog Collaborative Innovation Awards. The contributions of partner philanthropies toward Scialog awards brought this total to **\$7,065,000**. Funding partners in 2021 included the Paul G. Allen Frontiers Group, the Chan Zuckerberg Initiative, the Frederick Gardner Cottrell Foundation, the Heising-Simons Foundation, the Kavli Foundation, the Gordon and Betty Moore Foundation, NASA, the Climate Pathfinders Foundation, the Alfred P. Sloan Foundation, and the U.S. Department of Agriculture.

RCSA strives to be broadly inclusive in support of early career scientists. To learn more about our programs, visit the RCSA website at [www.rescorp.org](http://www.rescorp.org).



## Cottrell Scholar Program

Nurturing an interdisciplinary community of outstanding teacher-scholars, the CS program fosters synergy among faculty at major American and Canadian research universities and primarily undergraduate institutions. Cottrell Scholars receive an initial award of \$100,000, engage in an annual networking event to share insights and expertise, and have the opportunity to develop initiatives to enhance science education and scientist career development through the Cottrell Scholar Collaborative. Outstanding candidates in chemistry, physics, and astronomy are admitted to the ranks of Cottrell Scholars through a stringent peer-review process based on their innovative research and education proposals. Once designated a Cottrell Scholar, several levels of competitive funding to promote career growth become available under the Cottrell Plus Awards Program.

### 2021 Cottrell Scholar Awards

**Vinayak Agarwal**, Chemistry, Georgia Institute of Technology – *Unlocking Marine Eukaryotic Natural Product Biosynthetic Schemes in Research and Education*

**Jeanine Amacher**, Chemistry, Western Washington University – *Investigating Sortase Enzyme Activity and Specificity Using Natural Sequence Variation and Ancestral Sequence Reconstruction*

**Jeffrey Bandar**, Chemistry, Colorado State University – *Salt-Promoted Electron Transfer Processes for Reductive Cross-Coupling Reactions*

**Rachel S. Bezanson**, Astronomy, University of Pittsburgh – *Building Bridges in the Steel City: Leveraging the Nearby to Follow Galaxies Across Cosmic Time*

**Laura Blecha**, Physics, University of Florida – *The Making of a Gravitational Wave Source: Probing the Role of Galaxy Assembly in Black Hole Binary and Triple Formation*

**Justin R. Caram**, Chemistry, University of California, Los Angeles – *Chemical Physics Informed Design of SWIR Emissive Molecules*

**Joel F. Destino**, Chemistry, Creighton University – *Bottoms Up: Investigating the Growth and Glass-Forming Properties of Germania-Containing Colloids*

**Daniela Fera**, Chemistry, Swarthmore College – *Dissecting the Interactions and Conformations of Protein Kinases to Understand Biochemical Signaling*

**Alex Frañó**, Physics, University of California, San Diego – *Creating Artificial Angstrom-scale Periodic Potentials Using X-ray Standing Waves and Enhancing Creativity in Physics Education*

**Thomas L. Gianetti**, Chemistry, University of Arizona – *Developing a Photo-Rechargeable and Symmetrical Organic Redox Flow Battery*

**Natalie M. Gosnell**, Astronomy, Colorado College – *Constraining the Complexities of Stellar Activity with Sub-Subgiant Stars*

**Christopher H. Hendon**, Chemistry, University of Oregon – *Inorganic Defects in Metal-Organic Frameworks*

**Alexis C. Komor**, Chemistry, University of California, San Diego – *Harnessing Precision Genome Editing Tools to Study DNA Repair Proteins in Live Cells*

**Eli M. Levenson-Falk**, Physics, University of Southern California – *Creating Custom Quantum Environments with Superconducting Circuits (For Beginners)*

**Rosario Porras-Aguilar**, Physics, University of North Carolina at Charlotte – *Label-Free Reconfigurable Microscopy with High Specificity*

**Davit Potoyan**, Chemistry, Iowa State University – *Uncovering Principles of Bio-molecular Condensation: from Single Molecules to Cellular Organelles*

**Tyler D. Robinson**, Astronomy, Northern Arizona University – *Understanding the True Utility of Prior Mass Constraints in Characterizing Exoplanet Atmospheres and Diversifying STEM at NAU*

**Brian J. Shuve**, Physics, Harvey Mudd College – *Matter-Antimatter Asymmetry from Dark Matter Freeze-In*

**Marcelle Soares-Santos**, Physics, University of Michigan – *Cosmology with Merging Black Holes and Neutron Stars*

**Ruby May A. Sullan**, Chemistry, University of Toronto – Scarborough – *Multifunctional and Stimuli-Responsive Nanotherapeutic Platform for Targeted Disruption of Bacterial Biofilms*

**Alexandra Velian**, Chemistry, University of Washington – *Synthesis of Functional Metal Chalcogenide Lattices Using Symmetry-Encoded, Atomically Precise Clusters*

**Rongsheng (Ross) Wang**, Chemistry, Temple University – *A Fluorine Displacement Based Bioorthogonal Labeling Approach to Interrogate Non-Histone Substrates of “Histone” Deacetylases*

**Leah S. Witus**, Chemistry, Macalester College – *Investigation of Beta-Hairpin Hydrolytic Peptides and Development of an Advanced Undergraduate Scientific Communication Course*

**Joseph M. Zadrozny**, Chemistry, Colorado State University – *Harnessing Ligand-Shell Nuclear Spins to Control Molecular Spin Coherence*

**Gail Zasowski**, Astronomy, University of Utah – *Understanding the Chemical Enrichment of Our Universe: Unifying Evidence from the Milky Way and Other Galaxies*

**Total: \$2,500,000**

## Cottrell Scholars Collaborative

At the annual Cottrell Scholar Conference, participants are encouraged to form teams and develop collaborative projects with potential national impact in science education. Through this Cottrell Scholars Collaborative program, RCSA funded three projects in 2021 at \$25,000 each to support efforts to make higher education more inclusive and equitable:



### ***Cottrell Scholar Collaborative as Bridge for National DEI Efforts***

This project seeks to develop connections and promote partnerships between Cottrell Scholars and scientific societies and identity groups in science. In addition to developing an action guide to how individual faculty can contribute to any of these programs, the project aims to host a workshop to help foster relationships among allied organizations and individuals.

**Lead Cottrell Scholar: Rory Waterman**, Chemistry, University of Vermont

In collaboration with additional Cottrell Scholars:

**Jeanine Amacher**, Chemistry, Western Washington University

**Penny Beuning**, Chemistry, Northeastern University

**Rachel Bezanson**, Astronomy, University of Pittsburgh

**Laura Blecha**, Physics, University of Florida

**Jeffery Byers**, Chemistry, Boston College

**Lou Charkoudian**, Chemistry, Haverford College

**Catherine Kealhofer**, Physics, Williams College

**Charles McCrory**, Chemistry, University of Michigan

**David Strubbe**, Physics, University of California, Merced

**Jesús Velázquez**, Chemistry, University of California, Davis

Also with: **Philip “Bo” Hammer**, University of Chicago

### ***Art and the Creative STEM Classroom***

This project seeks to build a community of STEAM educators to create evidence-based modules incorporating non-traditional activities such as drawing or making, 3D printing, and other creative skills into undergraduate physics and chemistry classrooms, with the aim of improving student understanding of basic concepts and problem-solving skills, improving student communication about scientific ideas, and improving retention of historically underrepresented groups.

**Lead Cottrell Scholar: Elisabetta Matsumoto**, Physics, Georgia Tech

In collaboration with additional Cottrell Scholars:

**Tim Atherton**, Physics, Tufts University

**Adam Leibovich**, Physics, University of Pittsburgh

**Gina MacDonald**, Chemistry, James Madison University  
**Julio de Paula**, Chemistry, Lewis and Clark College  
**Paul Raston**, Chemistry, James Madison University  
**Jenny Ross**, Physics, Syracuse University

### ***A Cottrell Scholars Workshop on Authentic Grading in STEM and Holistic Evaluation of Students' Performance***

This project seeks to help faculty develop more authentic and equitable assessments of student abilities by hosting a workshop for the participants to hear about different grading practices that are becoming more widely used in academia, and to extend the discussion toward a more holistic interpretation of students' abilities by going beyond measures like the GPA or GRE scores.

**Lead Cottrell Scholar: Mario Affatigato**, Physics, Coe College

In collaboration with additional Cottrell Scholars:

**Michael Dennin**, Physics, University of California, Irvine

**Daniela Fera**, Chemistry, Swarthmore College

**Alex Frañó**, Physics, University of California, San Diego

**Carla Fröhlich**, Physics, North Carolina State University

**Katie Mouzakis**, Chemistry, Loyola Marymount University

**Rosario Porras-Aguilar**, Physics, University of North Carolina at Charlotte

**Juliane Simmchen**, Chemistry, Technische Universität Dresden

**Hanadi Sleiman**, Chemistry, McGill University

**Claire Till**, Chemistry, Humboldt State University

**Lauren Waters**, Chemistry, University of Wisconsin – Oshkosh

Also with: **Aaron Teator**, Chemistry, University of Kansas

**Total: \$75,000**

## **Cottrell Plus Awards**

As their scientific careers advance, Cottrell Scholars are eligible to receive post-tenure Cottrell Plus Awards to further support their research and educational activities. In 2021, SEED, IMPACT and STAR awards were given.

**SEED (Singular Exceptional Endeavors of Discovery) Awards** are competitive grants to launch new projects in research (at \$50,000 each) or education (at \$25,000 each). In 2021, five SEED Award winners (all for research) each received \$50,000, for a total of \$250,000:



**David DeMille, CS 2000, University of Chicago**

*Developing a New Tabletop-scale Approach to Detect Particles One Million Times More Massive than the Higgs Boson*

**Jonathan Friedman, CS 2002, Amherst College**

*Spin-Clock Transitions in Silica Defects*

**Steven Majewski, CS 1998, University of Virginia**

*Optical Fibers for Astronomical Imaging: Development and Use of the Distributed Field Fiber Imaging Testbed (DIFFIT)*

**John-David Smith, CS 2012, University of Toledo**

*Tiny Grains Across the Cosmos — The First Physical Models of PAH Emission in Cosmological Simulations*

**Ziqiang Wang, CS 1996, Boston College**

*Correlated and Topological Quantum States in Transition-metal Kagome Lattice Materials*

**IMPACT Awards** recognize the work of Cottrell Scholars who have had a national impact in science through their leadership and service activities. In 2020, the IMPACT Award of \$5,000 went to:



**Penny Beuning, CS 2009, Chemistry, Northeastern University**

**STAR (excellence in Science Teaching And Research) Awards** recognize the outstanding research and educational accomplishments of Cottrell Scholars and encourage the improvement of science education at American and Canadian universities and colleges. In 2021, STAR Awards of \$5,000 went to:

**Tim Clark, CS 2007, Chemistry, University of San Diego**

**Hanadi Sleiman, CS 1994, Chemistry, McGill University**

**Total: \$265,000**

## Cottrell Fellowships

RCSA awarded \$971,250 to 14 Cottrell Scholars to support the work of postdoctoral fellows whose plans to start independent academic or research careers this year were delayed or derailed due to institutional hiring freezes resulting from the pandemic. Three of these awards are funded through a \$225,000 grant from the National Science Foundation.

**Timothy Atherton** (postdoc **J. Anna Philips**) Tufts University \*

*Understanding Students' Expectations for Agency in Hands-On Learning Environment*

**William Dichtel** (postdoc **Anna Yang**) Northwestern University \*

*Porous Polymer Adsorbent for Sequestering Emerging Contaminants from Water*

**Mircea Dincă** (postdoc **Ruperto Mariano**) Massachusetts Institute of Technology \*

*Mechanistic Studies of O<sub>2</sub> Electroreduction to H<sub>2</sub>O<sub>2</sub> Using Conductive MOFs at Current Densities >100 mA cm<sup>-2</sup>*

**Gordana Dukovic** (postdoc **Katherine E. Shulenberger**) University of Colorado Boulder †

*Light-Driven Catalysis: Mechanistic Insights into Quantum Dot-Enzyme Hybrid Systems*

**Keary Engle** (postdoc **Malkanthi K. Karunananda**) Scripps Research Institute †

*Predictive Computational Models for the Development of Challenging Ni-Catalyzed Alkene Difunctionalizations with Transient Directing Groups*

**Claude-André Faucher-Giguère** (postdoc **Luke Kelley**) Northwestern University †

*Multi-Messenger Signatures of Massive Black Hole Binaries*

**Joshua Figueroa** (postdoc **Shuai (Vincent) Wang**) University of California, San Diego \*  
*Synthesis and Exploration of Carbyne Complexes of the Late 3d Transition Metals*

**Daniel Gamelin** (postdoc **Matthew Crane**) University of Washington \*  
*Tailoring Spin Dephasing in Metal-Halide Perovskites for Next-Generation Computing Applications*

**Taekjip Ha** (postdoc **Yang Liu**) Johns Hopkins University School of Medicine \*  
*Hijacking CRISPR-Cas9 as a Molecular Tool for Biology and Medicine*

**Alexis Komor** (postdoc **Zsolt Bodai**) University of California, San Diego \*  
*Investigations of DNA Repair Genes' Involvement in Base Editing and Development of a Hands-On Undergraduate Course on Genome Editing at UCSD*

**Stella Offner** (postdoc **Dávid Guszejnov**) University of Texas at Austin \*  
*The Role of Different Physical Processes in Star Formation*

**Eric Schelter** (postdoc **Nate Hirscher**) University of Pennsylvania \*  
*Aerobic, Photolytic Upgrading of Hydrocarbon Feedstocks*

**Keivan Stassun** (postdoc **Nina Hernitschek**) Vanderbilt University \*  
*Machine-Learning Applications for Variable Stars in the LSST and TESS Astronomical Surveys*

**Ann West** (postdoc **Meghan Kemper**) University of Oklahoma \*  
*Elucidating the Role of a Novel Response Regulator in Sporulation of *Clostridiodes difficile**

\* Funded by RCSA

† Funded by the National Science Foundation

**Total: \$971,250**



## **Scialog Collaborative Innovation Awards**

The Scialog program was created in 2010 by RCSA, which oversees its administration. Scialog – short for "science + dialog" – funds early career scientists to pursue transformative research with their fellow grantees on crucial issues of scientific inquiry. Scialog initiatives are a multi-year thematic investment, in which around 50 early career Scialog Fellows, facilitated by a group of leading scientists, convene annually to discuss cutting-edge multidisciplinary themes and propose high-risk collaborative projects.

RCSA convened six virtual Scialog conferences in 2021. Through Scialog Collaborative Innovation Awards, RCSA along with its funding partners provided a total of \$7,065,000 in seed funding for collaborative team projects.



## Signatures of Life in the Universe (Year 1)

**Goal:** To catalyze cutting-edge research with the potential to transform our understanding of the habitability of planets, of how the occurrence of life alters planets and leaves signatures, and of how to detect such signatures beyond Earth. Each of the 20 individual awards is for \$55,000.

**Greg Fournier**, Earth, Atmosphere and Planetary Sciences, Massachusetts Institute of Technology \*

**Stilianos Louca**, Biology, University of Oregon †

*Can the Search for Oxygenated Atmosphere Biosignatures Lead to False Negatives?*

**Jen Glass**, School of Earth and Atmospheric Sciences, Georgia Institute of Technology †

**Edwin Kite**, Geophysical Sciences, University of Chicago §

**Smadar Naoz**, Physics and Astronomy, UCLA †

*Methane from Nontraditional Abiotic Sources and Potential for False Biosignature Positives*

**Marc Neveu**, Dept. of Astronomy / Planetary Environments Laboratory, NASA Goddard Space Flight Center / University of Maryland ‡

**Ziming Yang**, Chemistry, Oakland University †

*How may Biosignatures in Icy Ocean Worlds be Affected by Plume Ejection?*

**Laurie Barge**, Planetary Sciences, NASA Jet Propulsion Laboratory ‡

**Jeffrey Marlow**, Biology, Boston University †

*Synthetic Mineral Geo-Electrodes for Detecting Life on Ocean Worlds*

**Rika Anderson**, Biology, Carleton College †

**Noah Planavsky**, Geology and Geophysics, Yale †

*Long Term Controls on the Scope of Earth's Biosphere*

**Bradford Foley**, Geosciences, Pennsylvania State University \*

**Kimberly Lau**, Geosciences, Pennsylvania State University \*

**Stephanie Olson**, Earth, Atmospheric, and Planetary Science, Purdue University \*

*Water, Water Everywhere ... Drops to Drink but Nothing to Eat? A Model for the Evolution of Ocean Chemistry on Waterworlds*



**Aaron Engelhart**, Genetics, Cell Biology, and Development, University of Minnesota \*  
**Meredith MacGregor**, Astrophysical and Planetary Sciences, University of Colorado Boulder \*  
**Laura Schaefer**, Geological Sciences, Stanford University \*  
*Could Nucleic Acid-Based Life Survive on Oxygen-Rich M Dwarf Planets?*

**Edwin Kite**, Geophysical Sciences, University of Chicago \*  
**Stilianos Louca**, Biology, University of Oregon \*  
**Chris Reinhard**, Earth and Atmospheric Sciences, Georgia Institute of Technology \*  
*Stochastic Simulation of Evolving Planetary Biospheres*

\* Funded by the Heising-Simons Foundation

† Funded by RCSA

‡ Funded by NASA

§ Funded by RCSA with Kavli Foundation support



## Microbiome, Neurobiology and Disease (Year 1)

**Goal:** To catalyze interdisciplinary teams including chemists, physicists, biologists and neurophysiologists to collaborate on new projects to advance fundamental understanding of the gut-brain axis and the roles microbiota play in neurodegenerative disorders. Each of the 14 individual awards is for \$55,000.

**Elaine Hsiao**, Integrative Biology & Physiology, University of California, Los Angeles

**Amina Schartup**, Scripps Institution of Oceanography

**Mei Shen**, Chemistry, Neuroscience Program, Beckman Institute, University of Illinois at Urbana-Champaign  
*Harnessing the Microbiome to Combat the Neurotoxic Effects of Dietary Mercury*

**Nandita Garud**, Department of Ecology and Evolutionary Biology, University of California, Los Angeles

**Will Ludington**, Embryology, Carnegie Institution

*Do Aging Microbiomes Evolve Pathogenicity Via Gene Shedding? Using Evolutionary Theory to Deconstruct Microbiome-based Neurodegeneration*

**David Durgan**, Anesthesiology, Baylor College of Medicine

**Abhishek Shrivastava**, School of Life Sciences, Arizona State University

*Do Bacterial Outer Membrane Vesicles (OMVs) Act as Modulators of Microbiota-brain Communication Involved in the Development of Neurological Diseases?*

**Faranak Fattahi**, Biochemistry and Biophysics, University of California, San Francisco

**Mark Mimee**, Microbiology/Pritzker School of Molecular Engineering, University of Chicago  
*Species-specific Modulation of Human Enteric Neurons by Gut Microbiome Metabolites*

**Maayan Levy**, Microbiology, University of Pennsylvania

**Ashley Ross**, Chemistry, University of Cincinnati

**Kai Zhang**, Biochemistry, University of Illinois at Urbana-Champaign

*Engineering Enteric Neuron Activity to Enhance Antimicrobial Immunity in the Gut*

**Carolina Tropini**, Microbiology and Immunology, School of Biomedical Engineering, University of British Columbia

**JP Yu**, Radiology, Psychiatry, and Biomedical Engineering, University of Wisconsin-Madison  
*Impact of Missing Microbes on Brain Development*

**Funded by RCSA, the Paul G. Allen Frontiers Group, and the Frederick Gardner Cottrell Foundation**



## **Advancing BioImaging (Year 1)**

**Goal:** To catalyze early career chemists, physicists, biologists, bioengineers and medical imaging specialists to collaborate on new and innovative projects to accelerate the development of the next generation of imaging technologies. Each of 23 individual awards is for \$50,000 in direct costs.

**Aseema Mohanty**, Electrical and Computer Engineering, Tufts University

**Sixian You**, Electrical Engineering and Computer Science, Massachusetts Institute of Technology  
*NeedleScope: Developing the Smallest Microscope for Bioimaging*

**Funded by RCSA, with support from the Frederick Gardner Cottrell Foundation**

**Nick Galati**, Biology, Western Washington University

**Shannon Quinn**, Computer Science, University of Georgia

**Doug Shepherd**, Physics, Arizona State University

*4-D Molecular Tracking Using Kilohertz Framerate Multi-Modal Microscopy*

**Funded by RCSA, with support from the Frederick Gardner Cottrell Foundation**

**Luke Mortensen**, Chemical, Materials and Biomedical Engineering, University of Georgia  
**Aniruddha Ray**, Physics & Astronomy, University of Toledo  
*Nanophotonic Probes for Ultra-Deep Functional Multiphoton Imaging*  
**Funded by RCSA, with support from the Frederick Gardner Cottrell Foundation**

**Yevgenia Kozorovitskiy**, Neurobiology, Northwestern University  
**Ping Wang**, Radiology, Michigan State University  
*Light-Sheet Imaging of 3D Bioprinted Islet Organoids Structure and Function*  
**Funded by RCSA, with support from the Frederick Gardner Cottrell Foundation**

**Benjamin Bartelle**, Biological and Health Systems Engineering, Arizona State University Fulton School of Engineering  
**Ulugbek Kamilov**, Computer Science & Engineering and Electrical & Systems Engineering, Washington University in St. Louis  
**Lu Wei**, Chemistry and Chemical Engineering, California Institute of Technology  
*Enabling Noninvasive Lipid Profiling with Intermodal Deep Learning*  
**Funded by the Chan Zuckerberg Initiative**

**Aseema Mohanty**, Electrical and Computer Engineering, Tufts University  
**Srigokul Upadhyayula**, Molecular and Cell Biology, University of California, Berkeley  
*Chip-scale Light Sheet for High Spatiotemporal Resolution Imaging*  
**Funded by the Chan Zuckerberg Initiative**

**Carolyn Bayer**, Biomedical Engineering, Tulane University  
**Allison Dennis**, Biomedical Engineering, Boston University  
*Deep Tissue Photoacoustic Imaging with Degradable Inorganic Nanoparticles*  
**Funded by the Chan Zuckerberg Initiative**

**Carolyn Bayer**, Biomedical Engineering, Tulane University  
**Sapun Parekh**, Biomedical Engineering, University of Texas at Austin  
**Paris Perdikaris**, Mechanical Engineering and Applied Mechanics, University of Pennsylvania  
*Machine Learning to Identify Soft Tissue Molecular Signatures*  
**Funded by the Chan Zuckerberg Initiative**

**Barbara Smith**, Biological and Health Systems Engineering, Arizona State University  
**Bryan Spring**, Physics, Northeastern University  
*Microendoscopy-Guided Diagnosis and Treatment of Early-Stage Ovarian Cancer*  
**Funded by the Chan Zuckerberg Initiative**

**Lisa Poulidakos**, Mechanical and Aerospace Engineering, University of California, San Diego  
**Douglas Shepherd**, Physics, Arizona State University  
*Wide-Field, Single-Pixel Fluorescence Imaging with On-Chip Nanophotonics*  
**Funded by the Chan Zuckerberg Initiative**



## Mitigating Zoonotic Threats (Year 1)

**Goal:** To catalyze multidisciplinary teams of early career scientists to launch new research in the detection and mitigation of emerging animal-borne infectious diseases. Each of the 25 individual awards is for \$50,000 in direct costs.

**Tavis Anderson**, Virus and Prion Research Unit, USDA

**Cheryl Andam**, Biological Sciences, University at Albany, SUNY

**Nicole Eikmeier**, Department of Computer Science, Grinnell College

*Darwin's Naturalization Conundrum Predicts Inter-species Pathogen Transmission Potential*

**Bethany McGregor**, Arthropod Borne Animal Diseases Research Unit, USDA

**Paola Boggiatto**, Infectious Bacterial Diseases Research Unit, USDA

**Jason Ladner**, Department of Biology, Northern Arizona University

*Enabling Comprehensive Immunoprofiling in Animals through a Combination of Xenosurveillance and Highly-multiplexed Serology*

**Laurene Tetard**, Department of Physics/Nanoscience Technology Center, University of Central Florida

**Bethany McGregor**, Arthropod Borne Animal Diseases Research Unit, USDA

*Employing Color-Changing Nanomaterials to Improve Vector-borne Disease Surveillance*

**Gonzalo Vazquez Prokopec**, Department of Environmental Sciences, Emory University

**Tavis Anderson**, Virus and Prion Research Unit, USDA

*Invasion Ecology and Genomics of Emerging Tick Borne Arboviruses: Predicting Niche Expansion of Heartland Virus Following the Invasion of Asian Longhorned Ticks in the U.S.*

**Paola Boggiatto**, Infectious Bacterial Diseases Research Unit, USDA

**Liliana Salvador**, Infectious Diseases & Institute of Bioinformatics, University of Georgia

*Host Adaptation of Mycobacterium bovis: A Comparative Transcriptomics Study of M. bovis Infection in a Multi-host System*

**Pilar Fernandez**, Paul G. Allen School for Global Animal Health, Washington State University

**Matthew Hopken**, National Wildlife Research Center, USDA

*Characterizing the Socio-ecological Spillover Interface by Xenosurveillance of Pathogen Metacommunities Using a Novel Insect Group*

**Crystal Hepp**, School of Informatics, Computing, and Cyber Systems, Northern Arizona University  
**Silvie Huijben**, School of Life Sciences, Arizona State University - Tempe Campus  
**Kezia Manlove**, Department of Wildland Resources and Ecology Center, Utah State University  
*Estimating Aedes aegypti Spillover Potential and Evaluation of Current Mitigation Strategies*

**Joyce Jose**, Department of Biochemistry & Molecular Biology, Pennsylvania State University  
**Kristin Koutmou**, Department of Chemistry, University of Michigan  
*Discovering How RNA Epigenomic Modifications Impact Flavivirus Replication Speed and Fidelity*

**Hannah Frank**, Ecology and Evolutionary Biology, Tulane University  
**Daniel Becker**, Department of Biology, University of Oklahoma  
**Jason Ladner**, Department of Biology, Northern Arizona University  
**Efrem Lim**, School of Life Sciences, Arizona State University - Tempe Campus  
*Zoonotic Implications of Host Genetics, Immunity, and Virome in Bats*

**Dana Mitzel**, Foreign Arthropod-Borne Animal Disease Unit, USDA's National Bio and Agro-Defense Facility  
**Joyce Jose**, Department of Biochemistry & Molecular Biology, Pennsylvania State University  
*Understanding Viral Factors Responsible for Vector Adaptation and Spillover for Surveillance and Mitigation of Zoonotic Flaviviruses with Pandemic Potential*

**Funded by RCSA and the U.S. Department of Agriculture**



### **Chemical Machinery of the Cell (Year 3)**

**Goal:** To spark collaborative research that could accelerate breakthroughs in fundamental understanding of chemical machinery and reactions in the intact cell. Each of the 24 individual awards is for \$55,000.

**Julien Berro**, Molecular Biophysics & Biochemistry, and Cell Biology, Yale University  
**Alexander Green**, Biomedical Engineering, Boston University  
*Intercepting the Cell's Hidden Signals via Peptide-Activated RNA Switches*

**Caitlin Davis**, Chemistry, Yale University

**Lars Plate**, Chemistry and Biological Sciences, Vanderbilt University

*Structure-Function of Enzyme Filaments: Regulators of Cell Metabolism in Space and Time*

**W. Seth Childers**, Chemistry, University of Pittsburgh

**Stephen Fried**, Chemistry, Johns Hopkins University

**Ross Wang**, Chemistry, Temple University

*Toward an Atlas of All Biomolecular Condensates*

**W. Seth Childers**, Chemistry, University of Pittsburgh

**Elizabeth Read**, Chemical and Biomolecular Engineering, University of California, Irvine

**Haoran Zhang**, Chemical and Biochemical Engineering, Rutgers University

*Putting Bacteria to Sleep: Establishing an Artificial Circadian Clock*

**Maria Kamenetska**, Chemistry and Physics, Boston University

**Jan-Hendrik Spille**, Physics, University of Illinois at Chicago

**Lu Wang**, Chemistry and Chemical Biology, Rutgers University

*The Butterfly Effect in Cellular Phase Separation: from Molecular Interactions to Emergent Behavior*

**Jan-Hendrik Spille**, Physics, University of Illinois at Chicago

**Stephen Yi**, Biomedical Engineering & Oncology, University of Texas at Austin

*Visualizing Inheritance through the Lens of Phase Separation*

**Stephanie Gupton**, Cell Biology and Physiology, University of North Carolina at Chapel Hill

**Alexis Komor**, Chemistry and Biochemistry, University of California, San Diego

**Yan Yu**, Chemistry, Indiana University

*Elucidating the Polygenic Origins of Schizophrenia: Linking Protein Trafficking to Synapse Function*

**Ronit Freeman**, Applied Physical Sciences, University of North Carolina at Chapel Hill

**Lydia Kisley**, Physics and Chemistry, Case Western Reserve University

**Laura Sanchez**, Pharmaceutical Sciences, University of Illinois at Chicago

*Stretching Reality to Discover the (un)Knowns*

**Stephen Fried**, Chemistry, Johns Hopkins University

**Tania Lupoli**, Chemistry, New York University

**Wenjing Wang**, Chemistry and Life Sciences Institute, University of Michigan

*Decoding Host-Pathogen Molecular Cross-talk via Unbiased Multiplex Profiling*

**Funded by RCSA and the Gordon and Betty Moore Foundation**



## Negative Emissions Science (Year 2)

**Goal:** To catalyze chemists, engineers, environmental scientists and those in related fields to collaborate on innovative projects to advance fundamental understanding of capturing and utilizing or sequestering carbon and other greenhouse gases in the atmosphere and oceans. Each of the 22 individual awards is for \$55,000.

**Matthew Green**, Chemical Engineering, Arizona State University †

**Gary Moore**, School of Molecular Sciences, Arizona State University †

**Emily Ryan**, Mechanical Engineering, Boston University †

*Electrocatalytic Activation and Cycling of Moisture-Swing Direct Air Capture Materials*

**Zhou Lin**, Chemistry, University of Massachusetts Amherst \*

**Yayuan Liu**, Chemical and Biomolecular Engineering, Johns Hopkins University \*

**Sen Zhang**, Chemistry, University of Virginia \*

*Carbon Dioxide-Methane Coupling with Electric-Field-Polarized Microelectrodes*

**Marta Hatzell**, Mechanical Engineering, Georgia Institute of Technology †

**Kathryn Knowles**, Chemistry, University of Rochester †

**Jose Mendoza**, Chemical Engineering and Materials Science, Michigan State University †

*Photochemical Amine Production from  $N_2$  and  $CO_2$*

**David Kwabi**, Mechanical Engineering, University of Michigan †

**Michael Nippe**, Chemistry, Texas A&M University, College Station †

*Carbon Dioxide Removal from Seawater Driven by a Visible Light-Induced pH Gradient*

**Matthew Green**, Chemical Engineering, Arizona State University \*

**Katherine Hornbostel**, Mechanical Engineering & Materials Science, University of Pittsburgh \*

**Jenny Yang**, Chemistry, University of California Irvine \*

*Novel Membrane Design for Hybrid Ocean Capture and Desalination*

**Charles McCrory**, Chemistry, University of Michigan †

**Carlos Morales-Guio**, Chemical and Biomolecular Engineering, University of California, Los Angeles †

*Electrified Low-Temperature Process for  $CO_2$  Capture and Conversion (e-LT-C3)*

**Andrea Hicks**, Civil and Environmental Engineering, University of Wisconsin - Madison \*

**Chong Liu**, Chemistry and Biochemistry, University of California, Los Angeles \*

**Haotian Wang**, Chemical and Biomolecular Engineering, Rice University \*

*CO<sub>2</sub> Conversion to Bioplastics via Electrochemical-Bio Synthesis*

**Adam Holewinski**, Chemical & Biological Engineering, University of Colorado Boulder \*

**Katherine Hornbostel**, Mechanical Engineering & Materials Science, University of Pittsburgh †

**Yuanyue Liu**, Mechanical Engineering, University of Texas at Austin \*

*Electric-Swing Solid State Sorbents for Direct Air Capture of CO<sub>2</sub>*

**\* Funded by RCSA, with support from the Climate Pathfinders Foundation**

**† Funded by Alfred P. Sloan Foundation**

**Total: \$7,065,000**

*(Summary includes award commitments made in 2021. Due to award terms and timing, totals may not be reflected in audited 2021 financial statements.)*

## The Year Ahead

RCSA has seven major conferences scheduled for 2022, which will be held virtually or in Tucson, Arizona.

**April – Scialog: Microbiome, Neurobiology and Disease**

**May – Scialog: Advancing Bioimaging**

**June – Scialog: Signatures of Life in the Universe**

**July – Cottrell Scholar Conference**

**September – Scialog: Mitigating Zoonotic Threats**

**October – Scialog: Molecular Basis of Cognition**

**November – Scialog: Negative Emissions Science**

Nominations for early career faculty to participate in Scialogs as Fellows, or senior faculty to serve as Scialog Facilitators, are welcome from colleagues, department heads, deans, vice presidents for research, or provosts. Institutions should also encourage eligible faculty (those in their third year with budgetary or courtesy appointments in chemistry, physics or astronomy) to apply for the Cottrell Scholar Award.

To learn more about RCSA and its programs, visit the website at [www.rescorp.org](http://www.rescorp.org) or contact:

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## About RCSA

Research Corporation for Science Advancement was founded in 1912 and is the second-oldest foundation in the United States (after the Carnegie Corporation) and the oldest foundation for science advancement. RCSA seeks to advance early stage, high-potential, basic scientific research by creating and supporting inclusive communities of early career researchers in the physical sciences and closely related fields at colleges and universities across the United States and Canada.